

**What is claimed is:**

1. A liquid crystal display television (LCD TV) comprising:

a liquid crystal display (LCD) screen panel for producing image to a viewer;

a projection-based backlight system comprising

5 a light source for supplying light;

polarizing means for polarizing the light supplied by the light source; and

a first projection lens for receiving the polarized light from the polarizing means and projecting the polarized light to the LCD screen panel.

10 2. The LCD TV as claimed in claim 1 further comprising a first mirror for receiving the polarized light from the first projection lens and reflecting the polarized light to the LCD screen panel.

3. The LCD TV as claimed in claim 1 further comprising a Fresnel lens disposed at a side of the LCD screen panel.

4. The LCD TV as claimed in claim 1, wherein the polarizing means comprises:

15 a polarization conversion element configured to receive the light from the light source and convert the light into polarized light; and

a condenser lens disposed between the polarization conversion element and the first projection lens, wherein the condenser lens is configured to condense the polarized light for the first projection lens.

20 5. The LCD TV as claimed in claim 4, wherein the polarizing means further comprises:

a relay lens disposed between the condenser lens and the first projection lens, wherein the relay lens is configured to direct the condensed light for the first projection lens.

6. The LCD TV as claimed in claim 5, wherein the polarizing means further comprises:

25 a polarizer disposed between the relay lens and the first projection lens, wherein the polarizer is configured to further polarize the directed light for the first projection lens.

7. The LCD TV as claimed in claim 6, wherein the polarizing means further comprises:

two lens arrays having a plurality of lenses respectively and being configured to receive the light from the light source and to compensate the light for the polarization

conversion element, wherein the two lens arrays are disposed opposite to each other and both are disposed between the light source and the polarization conversion element.

8. The LCD TV as claimed in claim 1, wherein the polarizing means comprises:

two lens arrays having a plurality of lenses respectively and being configured to receive the light from the light source and to compensate the light; and

a polarization conversion element configured to convert the compensated light into polarized light for the first projection lens;

wherein the two lens arrays are disposed between the light source and the polarization conversion element.

9. The LCD TV as claimed in claim 1, wherein the polarizing means comprises:

an integrating sphere having an entrance aperture and an exit aperture defined thereon, the integrating sphere configured to receive the light from the light source through the entrance aperture; and

a reflective polarizer disposed adjacent to the exit aperture and configured to allow a specific polarization light pass therethrough for the first projection lens and to reflect other polarization lights back into the integrating sphere.

10. The LCD TV as claimed in claim 9, wherein the polarizing means further comprises:

an integrating rod having an entrance-side end surface and an exit-side end surface, the integrating rod disposed adjacent to the reflective polarizer and configured to receive the specific polarization light and to direct it out through the exit-side end surface for the first projection lens.

11. The LCD TV as claimed in claim 10, wherein the polarizing means further comprises:

a condenser lens configured to condense the specific polarization light; and

a relay lens configured to direct the condensed specific polarization light from the condenser lens for the first projection lens;

wherein the condenser lens is disposed between the integrating rod and the relay lens.

12. The LCD TV as claimed in claim 1, wherein the polarizing means comprises:

a polarizing beam splitter having a light input side for receiving the light, a first split-light side adjacent to the light input side, a second split-light side opposite to the light input side, and a light output side opposite to the first split-light side, the polarizing beam splitter configured to split the light into first polarization light to pass directly through the second split-light side for the first projection lens and second polarization light to be directed toward the first split-light side.

13. The LCD TV as claimed in claim 12, wherein the first polarization light is P-polarization light and the second polarization light is S-polarization light.

14. The LCD TV as claimed in claim 12, wherein the polarizing means further comprises:

a second mirror configured to reflect the second polarization light;  
a half waveplate configured to receive the second polarization light from the second mirror and to convert the second polarization light into third polarization light; and

a second projection lens configured to receive the third polarization light from the half waveplate and to project the third polarization light to the LCD screen panel.

15. The LCD TV as claimed in claim 14, wherein the first polarization light and the third polarization light are the same polarization.

16. The LCD TV as claimed in claim 14, wherein the polarizing means further comprises:

a condenser lens disposed between the light source and the polarizing beam splitter;  
and

a relay lens disposed between the condenser lens and the polarizing beam splitter;  
wherein the condenser lens is configured to condense the light, and the relay lens is configured to direct the condensed light for the polarizing beam splitter.

17. The LCD TV as claimed in claim 16, wherein the polarizing means further comprises:

two lens arrays having a plurality of lenses respectively and being configured to receive the light from the light source and to compensate the light for the condenser lens, wherein the two lens arrays are disposed opposite to each other and both are disposed between the light source and the condenser lens.

18. A projection-based backlight system for an LCD TV having an LCD screen panel, comprising:

a light source for supplying light;

two lens arrays having a plurality of lenses respectively and being disposed opposite to each other, and both disposed adjacent to the light source and configured to receive the light from the light source and to compensate the light;

5 a polarization conversion element disposed adjacent to the lens arrays and configured to convert the compensated light into polarized light;

a condenser lens disposed adjacent to the polarization conversion element and configured to condense the polarized light;

a relay lens disposed adjacent to the condenser lens and configured to direct the condensed light;

10 a polarizer disposed adjacent to the relay lens and configured to further polarize the directed light; and

a projection lens disposed adjacent to the polarizer and configured to directly receive the polarized light from the polarizer and to project the polarized light to the LCD screen panel.

15 19. A projection-based backlight system for an LCD TV having an LCD screen panel, comprising:

a light source for supplying light;

20 an integrating sphere having an entrance aperture and an exit aperture defined thereon, the integrating sphere disposed adjacent to the light source with the entrance aperture facing the light source and configured to receive the light through the entrance aperture;

a reflective polarizer disposed on the exit aperture and configured to allow a specific polarization light pass therethrough and to reflect other polarization lights back into the integrating sphere;

25 an integrating rod having an entrance-side end surface and an exit-side end surface, the integrating rod disposed on the reflective polarizer and configured to receive the specific polarization light and to direct it out through the exit-side end surface;

a condenser lens disposed adjacent to the exit-side end surface of the integrating rod and configured to condense the specific polarization light;

30 a relay lens disposed adjacent to the condenser lens and configured to direct the condensed specific polarization light from the condenser lens; and

a projection lens disposed adjacent to the relay lens and configured to receive the specific polarization light from the relay lens and to project the specific polarization light to the LCD screen panel.

20. A projection-based backlight system for an LCD TV having an LCD screen panel,  
5 comprising:

a light source for supplying light;

two lens arrays having a plurality of lenses respectively and being disposed opposite to each other, and both disposed adjacent to the light source and configured to receive the light from the light source and to compensate the light;

10 a condenser lens disposed adjacent to the lens arrays and configured to condense the compensated light;

a relay lens disposed adjacent to the condenser lens and configured to direct the condensed light;

15 a polarizing beam splitter having a light input side facing the relay lens for receiving the directed light, a first split-light side adjacent to the light input side, a second split-light side opposite to the light input side, and a light output side opposite to the first split-light side, the polarizing beam splitter configured to split the directed light into first P-polarization light to pass directly through the second split-light side and S-polarization light to be directed toward the first split-light side;

20 a first projection lens disposed adjacent to the second split-light side of the polarizing beam splitter and configured to receive the first P-polarization light and to project the first P-polarized light to the LCD screen panel;

a second mirror disposed adjacent to the first split-light side and configured to reflect the S-polarization light;

25 a half waveplate disposed adjacent to the second mirror and configured to receive the S-polarization light from the second mirror and to convert the S-polarization light into second P-polarization light; and

30 a second projection lens disposed adjacent to the half waveplate and configured to receive the second P-polarized light from the half waveplate and to project the second P-polarized light to the LCD screen panel.